Research Article

Integrative Gastroenterology and Hepatology

Colonic Diverticulitis Complicated by Liver Abscess: Case Series and Review of Literature

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Abstract

Aim: Evaluate patients with colonic diverticulitis complicated by liver abscesses at a single center and provide review of literature.

Methods: Patients with colonic diverticulitis and liver abscess were identified via an administrative database and imaging search engine at Cedars Sinai Medical Center (CSMC). Clinical manifestations, laboratory and imaging findings and treatment strategies were assessed.

Results: We identified 10 patients with a median age of 59 and a 7:3 male: female ratio. The top presenting signs and symptoms were: fever (90%), malaise (70%), anorexia (60%), nausea (40%), and right upper quadrant abdominal pain (30%). Mean white blood cell count was 22.4 1000/UL, total bilirubin 2.59 mg/DL, and alkaline phosphatase 206.6 IU/L. Of the reported liver abscess cultures, 5 patients grew a single organism and 2 had multiple organisms. Most common bacteria genus was Streptococcus (n=4). Five patients had right hepatic abscesses, 3 had bilobar, and 2 had left hepatic abscesses. Four patients had locally complicated diverticulitis: 2 with paracolonic abscess and 2 with purulent peritonitis. Nine patients had CT-guided drainage of liver abscess, while 2 needed surgical drainage of liver abscess (one required both). Five patients had colectomy: 1 emergently and 4 electively. Two patients who did not have colectomy had recurrent diverticulitis, and underwent colectomy following recurrence.

Conclusion: Majority of patients with diverticulitis with liver abscess were males presenting with fever, and leukocytosis. Most had right liver lobe abscesses and most underwent colectomies. Diverticulitis with liver abscess is likely best treated as locally complicated disease and should undergo colectomy.

Keywords: Diverticulitis; Liver abscess; Hepatic abscess; Colonic diverticulitis; Sigmoid diverticulitis

Introduction

The incidence of diverticular disease has been reportedly increasing, especially in Western and industrialized nations [1]. In Western countries, the prevalence of diverticular disease ranges from 5-52%, while in Asia, prevalence is 1-19% [2]. Diverticulosis is more common in older patients and relatively rare in patients younger than 30 years of age. By the age of 60, approximately 40% of patients develop diverticulosis, with the incidence rising to over 60% in patients older than 80 years of age. In the United States, it is estimated that 10-25% of patients with diverticulosis will develop diverticulitis, and this number appears to be steadily rising [3]. There was a 7% increase in the incidence of diverticulitis in the last decade compared to the prior decade [4]. Of those with acute diverticulitis, about 10-25% are complicated with

pericolonic, pelvic, retroperitoneal, or liver abscesses[3].

Hepatic abscess is a rare complication of colonic diverticulitis. As such, the incidence of this specific complication is unknown. Additionally, there is little information on their clinical course and the recommended management of the colon in these patients. We hence sought to assess patients with liver abscess secondary to colonic diverticulitis at a single center and review the literature to gain a better understanding of their presentation, work-up, and treatment.

Methods

Search Strategy

Patients treated at Cedars Sinai Medical Center (CSMC) for diverticulitis complicated by liver abscess were identified in one of two ways: via review of the retrospectively collected Liver Disease and Transplant Center database dating back to 2010 and through Montage, a search engine at the Imaging Center that includes all imaging studies since 2015. The search terms included: "diverticulitis," in conjunction with "hepatic abscess," "liver abscess," "liver cyst" "liver lesion," "liver mass," and "liver fluid collection".

Inclusion and Exclusion Criteria

We limited the search to patients seen at CSMC after 2010 or 2015, depending on the search strategy employed (see above). Patients were included if they had colonic diverticulitis and liver abscess in the same imaging study or diverticulitis in the 30 days preceding imaging showing liver abscess. Liver abscess was defined as a fluid collection in any segment of the liver suspicious for an abscess based on density and associated air pockets. Diverticulitis was defined as the presence of bowel wall thickening in area of diverticula. Other findings considered were pericolic fat stranding, abscess, and extraluminal air, fluid, stool or contrast.

If the patient was not diagnosed with diverticulitis or developed diverticulitis after the onset of liver abscess formation, they were excluded. Small bowel diverticulitis was excluded. Patients with liver cysts, hematomas, hemangiomas or solid nodules/masses without evidence of abscess were excluded. We excluded thrombophlebitis of the hepatic vein, a potential complication of diverticular disease that may ultimately result in suppurative hepatic abscess. We sought to focus on gross hepatic abscess that has surgical or procedural significance and application.

Data Extraction

After patients were identified, their electronic medical records were retrospectively reviewed by one reviewer (MU). The principal investigator (YN) monitored the data collection process for accuracy and clarity. Each patient's demographic information was collected, including, age, sex, and race. Other data included: presenting signs and symptoms (e.g. abdominal pain, fever/chills, nausea/vomiting, etc.), laboratory results, liver abscess culture, imaging results, and image-guided and surgical management. The following laboratory results were collected: white blood cell count (WBC), liver function tests (total bilirubin [TB], direct bilirubin [DB], aspartate aminotransferase [AST], alanine aminotransferase [ALT], and alkaline phosphatase [AP]), and inflammatory markers (erythrocyte sedimentation rate [ESR], C-reactive protein level [CRP]). Mayo Medical Laboratory's reference ranges were utilized [5]. If a value was not recorded in the patient's chart, it was marked, "not available" (NA).

Results

Ten patients, 7 males and 3 females, with a median age of 59 years (range = 47-86) with diverticulitis and liver abscess were identified. Seven patients were Caucasian, two African American, and one Asian. Patients were followed for a median of 16 months (range = 1–84 months). Demographic information is summarized in table 1.

The most common presenting signs and symptoms (figure 1) in decreasing order of frequency were fever/chills (90%), malaise/weakness (70%), loss of appetite/anorexia (60%), nausea/vomiting (40%), isolated right upper quadrant (RUQ) abdominal pain (30%), weight loss (30%), generalized abdominal pain (20%), and jaundice (10%). Isolated left lower quadrant (LLQ) abdominal pain was not observed. Overall, the mean presenting temperature was 99.9°F (range 97.3-102.6°F). Forty percent of patients had a fever (>100.4°F) upon arrival to the hospital.

All patients had an elevated WBC (>10.5 1000/UL, mean = 22.4 1000/UL). Most patients (70%) had higher than normal (>75%) neutrophil counts (mean = 80.3%), and most also had elevated direct bilirubin (70% > 0.3 mg/DL, mean = 2.03 mg/DL), ALT (70% > 55 IU/L, mean = 96.1 IU/L), AP levels (90% > 115 IU/L, mean =206.6 IU/L), and AST (60% > 49 IU/L, mean = 113.4 IU/L). Sixty percent of the patients had low albumin levels (< 3.5 g/DL, mean = 3.09 g/DL). Four of the 10 patients had elevated total

bilirubin with a mean value of 2.59 mg/DL. Laboratory results are summarized in table 2.

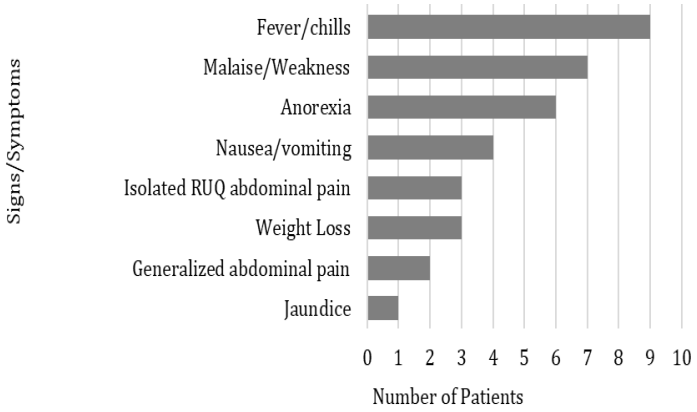

Figure 1: Presenting Signs and Symptoms

Patients' presenting signs and symptoms are shown in decreasing order or frequency from top to bottom. RUQ=right upper quadrant, LLQ = left lower quadrant

Two patients had two or more bacteria species growing in their liver cultures, while 5 had a single organism. Three patients had negative liver abscess cultures, presumably due to antibiotic treatment prior to undergoing liver abscess drainage. The most common genus of bacteria was Streptococcus (n = 4). All other genera were observed only once (*Candida, Lactobacillus, Fusobacterium, Klesiella/ Roaltella, Citrobacter, and Enterococcus*).

Five (50%) patients had abscesses in the right hepatic lobe only, 3 (30%) had bilobar abscesses, and 2 (20%) had only left hepatic lobe abscesses. Three (30%) patients had one abscess, 2 (20%) had 2 abscesses, 2 (20%) had 5 abscesses, and 3 (30%) had more than 5 abscesses. The mean diameter of all abscesses, excluding sub centimeter abscesses, was 5.7 cm. All patients had at least one abscess that was 3cm or larger.

Imaging revealed that 6 (60%) patients had locally complicated diverticulitis. Three (30%) patients had paracolonic abscesses, 1 (10%) had pelvic abscess, and 2 (20%) had purulent peritonitis. All paracolonic and pelvic abscesses found were deemed too small to be drained.

All patients underwent liver abscess drainage. Two patients had their abscess surgically drained and 9 patients had CT-guided drainage. One patient required surgical drainage at an outside facility followed by CT-guided drainage at CSMC.

Five patients underwent colectomy, 4 electively with primary anastomosis performed after liver abscess and acute diverticulitis resolved, and one urgently with colectomy and colostomy during the acute phase of diverticulitis. Elective procedures took place, on average, 4.4 months after CT scan revealed liver abscess. One individual had an elective colectomy after resolution of liver abscesses and following recurrent diverticulitis. The patient who underwent an urgent colectomy had purulent peritonitis. This patient ultimately underwent colostomy closure 32 months later. Of the patients who had elective colectomy, one presented with peritonitis at another facility where she underwent an emergent exploratory laparotomy with drainage of purulent fluid, as well as drainage of colonic and hepatic abscesses without colectomy. This patient was then transferred to CSMC and required repeat CT-guided drainage of her hepatic abscess. The patient was discharged home without additional surgery during that admission. About 4.5 months after initial presentation, the patient underwent elective sigmoidectomy with anastomosis.

Table 1: Demographic Information

	Sex	Age	Race
1	F	72	Caucasian
2	F	73	Caucasian
3	F	86	Caucasian
4	M	47	Caucasian
5	M	50	Caucasian
6	M	53	African American
7	M	53	Caucasian
8	M	59	African American
9	M	62	Caucasian
10	M	64	Asian

Table 2: Laboratory Results

	WBC 1000/UL	Neutro-phil %	TB mg/DL	DB mg/ DL	AST IU/L	ALT IU/L	AP IU/L	Albumin g/DL	ESR mm/ hr
1	*34.7*	*91%*	1.1	*0.4*	*229*	54	*321*	*2.6*	NA
2	*20.9*	*90%*	*2.4*	*1.7*	*58*	*70*	*245*	*3.2*	NA
3	*21*	*88%*	0.5	0.2	24	43	*144*	*2.7*	NA
4	*23.8*	*78%*	*15.3*	*13.9*	*182*	*85*	*373*	*2.2*	64
5	*28*	73%	0.4	0.1	24	18	*259*	3.7	NA
6	*12.1*	72%	0.3	0.2	23	10	73	*2.4*	NA
7	*20.4*	*88%*	*1.3*	*0.6*	*173*	*187*	*176*	3.8	NA
8	*16.9*	63%	1.1	*1*	*65*	*63*	*128*	3.6	NA
9	*22.7*	*79%*	0.9	*0.5*	43	*59*	*139*	3.9	NA
10	*23.2*	*81%*	*2.6*	*1.7*	*313*	*372*	*208*	*2.8*	NA
Mean	22.4	80%	2.6	2	113	96	207	3.1	64

Italic values are considered abnormal, based on Mayo's reference ranges.

WBC = white blood cell count, TB = total bilirubin, DB = direct bilirubin, AST = aspartate aminotransferase, ALT = alanine aminotransferase, AP = alkaline phosphatase, ESR = erythrocyte sedimentation rate

Four patients did not undergo a colectomy, one of whom had locally complicated diverticulitis with small paracolonic abscess. Two of these patients did not see a provider within the CSMC system following discharge, and hence medical records following their discharge could not be obtained. Another patient was followed for about 7 years and scheduled to undergo a colectomy about 6 years after initial presentation due to another flare-up of diverticulitis.

Though no recurrences of liver abscess were observed, two patients had recurrent diverticulitis. Both patients originally had locally uncomplicated diverticulitis and did not undergo colectomy. One patient had recurrence 5 months after initial presentation and underwent elective colectomy 6 weeks following recurrence. The other patient had recurrent diverticulitis 4.3 years following diagnosis of diverticulitis with liver abscess. This individual was scheduled to undergo a colectomy about 6 years after initial presentation.

Discussion

The mechanism by which liver abscess occurs secondary to colonic diverticulitis is not fully understood. Compromised immunity due to diverticulitis itself could be a predisposition for liver abscess. Additionally, disruption of the intestinal mucosal membrane, which exposes underlying vasculature, may promote hematogenous spreading of colonic bacteria into portal circulation and make its way to liver parenchyma [6].

To further enhance our understanding of diverticulitis complicated by liver abscess, a systematic review of the literature was also conducted to assess presentation, evaluation, and treatment of these patients. A literature search was conducted via PubMed, Embase, Medline, Scopus and the Cochrane Library for the period 1989-2016 using the search terms: 'diverticulitis', 'colon', 'sigmoid', 'liver abscess', 'hepatic abscess', and 'intrahepatic abscess.' We limited the search to papers after 1989 to reflect the more modern management of diverticulitis complicated by liver abscess, especially with the aid of computed tomography (CT) scan and CT-guided drainage. Due to the paucity of data, all study types were deemed acceptable for inclusion. An article was selected for inclusion if written in the English language and the author reported one or more patients with both diverticulitis and liver abscess(es). Letters, comments, conference proceedings, and papers with only abstracts available were excluded. If a study gave no information in a particular data category, it was marked as "not available" (NA). The search yielded 11 case studies, with one patient per study [6–16].

Median age in the literature was 59 (range = 42-71), same as the median age of 59 in our case series (range = 47-86). The male: female ratio in the literature was 10:1, comparable to predominance of males in our case series (7:3). For comparison, overall incidence of liver

abscesses of all etiologies has equal male to female ratio [6,14,17]. Although we found a higher prevalence of liver abscesses as result of diverticulitis in males, it is difficult to determine whether this is reflective of the population or a result of sampling error. Additionally, we observed predominance of Caucasians with this disease: 7 of 10 patients in our study and 4 of 6 patients in the literature with recorded race or ethnicity were Caucasians (Table 3).

By and large the patients in our case series experienced either generalized abdominal pain or right abdominal pain only. Left lower quadrant abdominal pain in isolation was not observed. This is consistent with what was found in the literature. This may reflect the severity of liver abscess over colonic diverticulitis.

Almost all the patients in our series and in the literature were febrile upon presentation to the hospital. The mean presenting temperatures of the patients in the literature and our case series were 100.2°F and 99.9°F, respectively. Additionally, most patients in both cohorts presented with weakness or malaise (Figure 2).

In our series, half or more of the patients had a high WBC, neutrophil count, and direct bilirubin level, and low albumin levels. Similarly, all patients in the literature had elevated WBC values (>10.5 1000/UL). Liver function tests were not consistently reported in the literature, but most had elevated AP levels (7/8). Beyond WBC and AP, most studies in the literature fail to report pertinent laboratory results, severely hindering the quality of available data.

Streptococcus, native to but not common in the colon, was found to be the most common bacterial genus in our series, found in 3 patients' liver abscesses. The most commonly observed bacterial genus noted in the literature was Bacteroides (n=4) followed by E.coli (n=3). Both Bacteroides and E. coli are common colonic bacterial species [18]. Four of 9 patients in the literature and 2/10 patients in our case series had multiple organisms in their liver abscess cultures. Flora could have potentially been altered based on the length of antibiotic treatment prior to obtaining liver abscess culture.

Majority of the patients in our case series and in the literature had abscesses in their right hepatic lobe. All but one patient in the literature had an abscess in the right hepatic lobe, half of whom had bilobar abscesses. Similarly, in our series, 80% of patients had an abscess in the right lobe of their liver. Three of these 8 patients had bilobar abscesses. It hence appears that the predominant distribution of abscesses in the right lobe of the liver mirrors that of colonic cancer metastases to the liver. Assessing 410 patients with colorectal liver metastases, Rhu et al. found that for right-sided colon cancer, the ratio of metastatic disease between the right and left liver was 2.20:1, while for left-sided colon cancer, it was 1.39:1[19]. It is thought the unequal distribution of metastases and abscesses between the two sides of the liver is due to incomplete mixing of blood from superior and inferior mesenteric veins within the portal vein, which ultimately supplies unequal amounts of blood to the left and right hepatic lobes.

Five case reports commented on liver abscess size. Looking at the largest abscess described for each patient,

Table 3: Demographic Information from Literature

Study	Sex	Age	Race
Saxena R, et al.	F	58	Caucasian
Mali P, et al.	M	42	–
Chatzipetrou M, et al.	M	51	–
Murarka S, et al.	M	52	Caucasian
Wang YJ, et al.	M	57	Asian
Steinhart AH, et al.	M	59	–
Wijarnpreecha K, et al.	M	59	Caucasian
Suna C, et al.	M	60	–
Yoshida M, et al.	M	61	Asian
Joshi V, et al.	M	66	–
Hajjar NA et al.	M	71	Caucasian

– Indicates the authors did not note the race of the patient in the case report

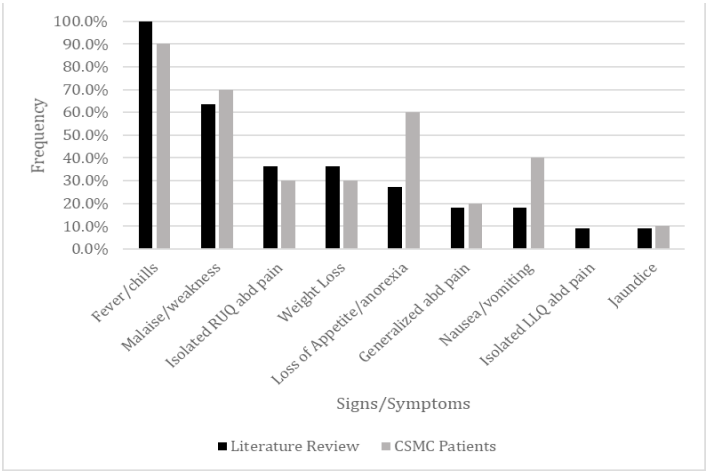

Figure 2: Comparison of Signs and Symptoms

Literature and CSMC Patients' presenting signs and symptoms are shown in decreasing order or frequency. RUQ = right upper quadrant, LLQ = left lower quadrant.

the mean abscess diameter in the literature was 6.1 cm, while for our case series it was 7.1 cm. All patients in the literature and our series had an abscess size of at least 3 centimeters which is commonly the cutoff used by radiologist to favor CT guided drainage in their treatment. Interestingly, 60% of patients in our case series and third of patients in the literature had locally uncomplicated diverticulitis, while still having sizable liver abscesses.

All patients' liver abscesses in our series were drained, usually by CT-guidance. The two patients who underwent surgical drainage instead, were taken to the operating room for purulent peritonitis. Most patients (8/11) in the literature also had their liver abscess drained; most (6/8) with CT guidance. Thus, it appears that unless an urgent operation was needed due to local complication of diverticulitis, CT-guided drainage of liver abscess is preferred and adequate.

Sixty percent of patients in our series underwent colectomy. Of the 4 remaining patients, 2 (40%) had recurrent diverticulitis. After recurrence, both patients were scheduled for an elective colectomy, but only one patient ultimately had the procedure. Similarly, almost all patients in the literature also underwent colectomy, 3 electively and 7 urgently. The preference of surgeons to perform colectomies both in our series and in the literature reflects the thought of surgeons to treat this disease the same as other complicated cases of diverticulitis. High rate of colectomies and recurrence rates both in our series and literature serve as a strong argument for these patients to have an elective colectomy.

We believe that our paper contributes to overall knowledge about presentation of patients with diverticulitis complicated by liver abscess and yields important recommendation in treatment of the colon. Here are the noteworthy points in these patients' presentations: 1) male predominance, 2) patients tended to have right sided or generalized abdominal pain as opposed to the common diverticulitis symptom of left lower quadrant abdominal pain, 3) abscesses favored the right lobe of the liver, 4) abscesses were larger than the common cut off point of 3cm to qualify for CT-guided drainage.

In treating these patients, the liver abscess is treated first and preferentially. Patients are generally started on broad spectrum antibiotics with gram positive and gram negative bacterial coverage and occasionally on antifungals depending on a given patient's co-morbidities and immunosuppressive state. Following abscess culture results, antibiotic coverage is modified accordingly. Liver and/or colonic abscesses greater than 3cm are drained with CT guidance. Treatment of hepatic abscesses due to diverticulitis is essentially the same as hepatic abscesses due to other etiologies. The most important management derivation from our papers is that performance of colectomy is commonly recommended for diverticulitis with local complications. This should preferably be performed electively 6-8 weeks from acute presentation and following resolution of liver abscesses and colonic diverticulitis. Prior studies have suggested that recurrence of diverticulitis is up to 60% in patients with diverticulitis complicated by colonic abscess following CT-guided drainage who did not undergo colectomy [20,21]. We recommend treatment of patients with diverticulitis complicated by liver abscesses to mirror that of patients with diverticulitis complicated by local abscess, who most agree should undergo colectomy. This recommendation is based on our findings; both from preference of surgeons in our institution and those in the literature to perform colectomy. We found a 50% recurrence rate of diverticulitis among patients in our institution who did not undergo colectomy following complication with liver abscess. The other 50% of patients who did not have colectomy were not able to be followed after their hospital stay, and so it is not possible to reliably determine if these patients had recurrence.We recommend treatment of patients with diverticulitis complicated by liver abscesses to mirror that of patients with diverticulitis complicated by local abscess, who most agree should undergo colectomy. This recommendation is based on our findings; both from preference of surgeons in our institution and those in the literature to perform colectomy. We found a 50% recurrence rate of diverticulitis among patients in our institution who did not undergo colectomy following complication with liver abscess. The other 50% of patients who did not have colectomy were not able to be followed after their hospital stay, and so it is not possible to reliably determine if these patients had recurrence.

This case series and literature review is largely limited by sample size and retrospective nature. Additionally, because this was a single-center study, some patients were seen at another facility following their hospitalization, hindering the quality of follow-up data collected. The information available from the literature was mainly restricted by sample size and completeness of reported data. Furthermore, follow-up information was often not thoroughly discussed in the case studies.

Our case series analyzed 10 patients with diverticulitis complicated by liver abscesses, hence making it the largest case series to date on the subject. It is further enhanced by thorough literature review on the topic. Majority of patients with diverticulitis with liver abscess had right lobe abscesses and most underwent colectomies. Diverticulitis with liver abscess is likely best treated as locally complicated disease and should undergo colectomy. More robust studies with higher quality of outcome data are necessary to gain a better understanding of this disease process.

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The institutional review board (IRB) at Cedars Sinai Medical Center approved the study.

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